



- N.B. (1) Solve any **five** question including question number **1** is **compulsory**.  
 (2) **All** questions carry **equal** marks.  
 (3) Use on non-programmable calculators and log table **allowed**.  
 (4) **Figures** to the **right** indicate the **full** marks.  
 (5) Assume suitable **data** wherever **necessary** and mention it **clearly**.

Q.No.1 Write short notes on:

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- Exponential smoothing model.
- Types of manufacturing system.
- MRP and MRP II.
- Master production schedule.

Q.No.2 (a) Use simplex method to solved the following problem

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Maximize:

$$Z = 2x_1 + 5x_2,$$

Subject to:

$$-x_1 - 2x_2 \geq -8,$$

$$x_1 \leq 4,$$

$$0 \leq x_2 \leq 3,$$

$x_1$  unrestricted.

- (b) A farmer has a 100 acre farm. He can sell all the tomatoes, drumstick or radishes he can raise. The price he can obtain is Rs 1.00 per kg for tomatoes, Rs 0.75 for a head of drum stick and Rs 2.00 per kg for radishes. The average yield per acre is 2,000 kg of tomatoes, 3,000 heads of drumstick, and 1,000 kg of radishes. Fertilizer is available at 0.50 per kg and the amount required per acre is 100kg each for tomatoes and drumstick, and 50 kg for radishes. Labour required for sowing cultivating and harvesting per acre is 5 man - days for tomatoes and radishes and 6 men -days for drumstick. A total of 400 man-days of labour are available at Rs 20.00 per man -days. Formulate this problem as a linear programming model to maximize the farmer's total profit.

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Q.No.3 (a) Given the following data :

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Job	1	2	3	4	5	6
Machine A	12	10	9	14	7	9
Machine B	7	6	6	5	4	4
Machine C	6	5	6	4	2	4

- Order of processing job: ACB.
- Sequence suggested: jobs 5,3,6,2,1,4.
  - Determine the total elapsed time for the sequence suggested.
  - Is the given sequence optimal?
  - If your answer to (ii) is no determine the optimal sequence and the total elapsed time associated with it.
  - Also determine idle time for each machine for the sequence obtained in (iii).

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- (b) A project consists of 8 activities. Precedence relation and activity times are given. Draw the network and compute the critical path show the slack for each activity in a tabular form.

Activity	Immediate Predecessor	Activity Time (Weeks)
P	-	12
Q	-	20
R	-	28
S	R	12
T	P, Q	28
U	T, S	12
V	S	8
W	U, V	8

- Q.No.4 (a) Solve the following transportation problem using Vogel's method in order to minimize the total transportation cost. The values in the body of the matrix represent the unit transportation cost.

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Origin	Destination				Supply
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	
O <sub>1</sub>	12	7	10	10	40
O <sub>2</sub>	10	9	12	10	30
O <sub>3</sub>	14	12	9	12	20
Demand	30	25	15	10	

- (b) The annual demand for a machine component is 24,000 units. The carrying cost is Rs 0.40 unit/year, the ordering cost is Rs 20.00 per order and the storage cost is Rs 1,000 /unit/year. Find the values of the following:

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- Economic order quantity
- Maximum inventory
- Maximum storage quantity
- Cycle time
- Inventory period
- Shortage period

- Q.No.5 (a) Revenue and manufacturing cost data is given below for different plants and products combination, which product to which plant gives maximum profit.

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Products	Plants							
	Sales Revenue Rs. (000)				Manufacturing cost Rs (000)			
	1	2	3	4	1	2	3	4
A	50	68	49	62	49	60	45	61
B	60	70	51	74	55	63	45	69
C	55	67	53	70	52	62	49	68
D	58	65	54	69	55	64	48	64

(b) Convert primal in to Dual

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Maximize:

$$Z = 3x_1 - 5x_2 - 3x_3,$$

Subject to;

$$2x_1 + 4x_3 \leq 12,$$

$$x_1 - 2x_2 + x_3 \geq 6,$$

$$5x_1 + x_2 = 10,$$

$$x_1, x_2, x_3 \geq 0.$$

(c) What is unbalanced assignment problem? How it is solved by Hungarian method?

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Q.No.6 (a) The time spent in processing of two jobs on six machines A, B, C, D, E, F and necessary technological ordering of machines are as follows:

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Job 1	sequence	A	B	C	D	E	F
	Time(min)	20	10	10	30	25	15
Job 2	sequence	A	C	B	D	F	E
	Time(min)	10	30	15	10	15	20

Use graphical method to determine an optimal sequence of jobs which minimizes elapsed time.

(b) The following data gives sales of the company for previous years. Fit the straight line and forecast the sales for year 1998 and 1999

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Years	1989	1990	1991	1992	1993	1994	1995	1996	1997
Sales Rs (000)	13	20	20	28	30	32	33	38	43

Q.No.7 Explain :

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- The various strategies for Aggregate Planning.
- Monte Carlo simulation method by using suitable example.
- JIT Seven Wastages.
- The techniques of SFC (Shop Floor Control)